LOW BACKGROUND FACILITIES

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(I) GENERAL SUMMARY

The LBNL Low Background Facilities at both Berkeley and Oroville continued to operate with full schedules throughout this period. Major efforts at the Berkeley facility have included: 1) continuation in the key role for characterizing waste (concrete blocks, other shielding materials, beam line and main accelerator magnets) for the Bldg 51 disposal project; 2) validating the use of auto engine air intake filters as monitors for airborne radioactive contamination following a terrorist nuclear attack or nuclear accident; 3)use of both neutron activation analysis (INAA) and direct counting to determine radioactive contamination in construction materials for double beta-decay, neutrino, and dark matter experiments; 4) development of an accurate neutron activation based monitoring technique for production of the large number (approximately 2000) NTD germanium thermistors that will be needed for the CUORE Te-130 double beta-decay experiment. Major efforts at the Oroville facility included items (2) and (3) above, as well as tests of a highly segmented HPGe detector of the type that would be used in the proposed MAJORANA experiment.

Through techniques developed at and measurements made by LBF personnel, the external beam facility (EPB) components of the Bevalac have been characterized and disposed. In addition, the top course of the two-layer main shield roof has been disposed to a private facility which crushed these blocks in order to permit recycling the concrete rubble as road metal. Prior measurements of the accelerator structure and surrounding shield, along with historical knowledge of accelerator operating performance, have played major roles in crafting a plan for demolition of the main accelerator, surrounding shield structure, concrete foundation beneath, and the building itself.

Support of existing and proposed experiments in Item (3) above include direct counting of materials for SNO, KAMLAND, CFPA's project at the Soudan Mine, CUORE, and KATRIN. One notable example of an INAA application relates to teflon, a major construction material that will be in contact with the TeO crystal detectors. Heretofore considered a CLEAN material, our measurements show the teflon stock intended for use in the CUORE detector array contains concentrations of both U- and Th-series nuclides that could be significant contributors to BKG levels projected for success of the experiment.

Protocols have been developed and validated for use of automotive air filters as reliable collectors of airborne radionuclides, as would be required in the event of a terrorist nuclear attack or nuclear accident. Details of this project are presented separately in a companion document describing LBF activities.

(II) AUTOMOTIVE AIR FILTERS TO MEASURE AIRBORNE RADIONUCLIDES:Homeland Security Application

The basic principle of the Homeland Security oriented auto engine air rilter project is to provide information concerning airborne radionuclides collected on intake air filters from the millions of "samplers" that are constantly deployed (at no extra effort or expense) and provide complete detailed nationwide coverage. This information will then be used to map the extent and severity of a nuclear attack, or to identify a false alarm. The program was initiated internally late in 2001, finally received external funding at the beginning of calendar 2004, and is now in a second year of this support. The principle has been validated through the following accomplishments.

Detailed analyses have been done on filters obtained at maintenance change from law enforcement patrol vehicles at Berkeley (city) and Oroville (Butte County) continuously since early 2002. A total of nearly 1000 filters, including a sampling from cities outside California, have been analysed to date. Cosmogenically produced Be-7 and Rn-222 daughter Pb-210 are seen on all filters; K-40 and atmospheric weapons-test relic Cs-137 are occasionally observed on particularly dust-laden filters, mainly from Butte County. No unexpected radionuclides have been detected on these filters.

We have measured the absolute collection efficiency for naturally-occurring airborne radionuclides for one widely-used type of filter. It is approximately 40% as efficient as the standard filters used at LBNL for atmospheric sampling. A network of laboratories capable of detailed analyses for the radionuclides collected on filters has been established; each has been sent a filter containing known amounts of naturally-occurring radionuclides to serve as calibrators for the atypical shape/size of these samplers. So-called "screening detectors" have been installed at both Berkeley and Oroville. These detectors, of which large numbers would be deployed nationwide, measure gross levels of radioactivity. A significant excess above a locally determined "Background" would be the trigger for further action, such as immediate dispatch to the nearest full-analysis laboratory. The system is ready for wide-scale deployment. We only lack the requisite "pot of gold" to do so.